
NT8D02 Digital Line Card

Introduction

The NT8D02 Digital Line Card is an intelligent peripheral equipment (IPE) device that can be installed in either the NT8D37 IPE Module or the NT8D11 CE/PE Module. It provides 16 voice and 16 data communication links between a Meridian 1 switch and modular digital telephones.

The digital line card supports voice only or simultaneous voice and data service over a single twisted pair of standard telephone wiring. When a digital telephone is equipped with the data option, an asynchronous ASCII terminal or personal computer acting like an asynchronous ASCII terminal can be connected to the system through the digital telephone.

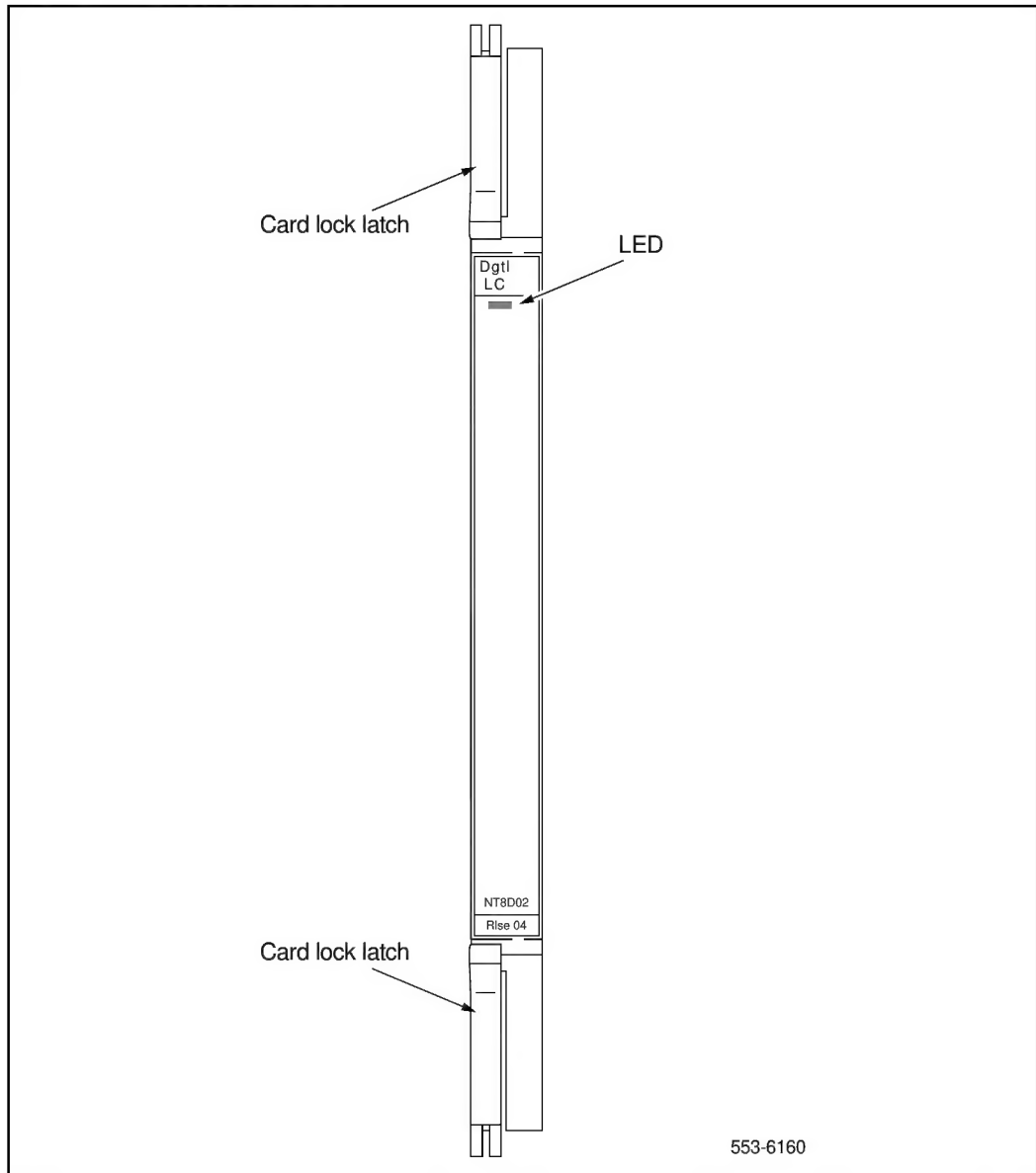
Physical description

Digital line cards are housed in NT8D37 Intelligent Peripheral Equipment (IPE) Modules (up to 16 cards) or NT8D11 Common/Peripheral Equipment (CE/PE) Modules (up to 10 cards).

The digital line card circuitry is mounted on a 31.75 cm by 25.40 cm (12.5 in. by 10 in.) double-sided printed circuit board. The card connects to the backplane through a 160-pin edge connector.

The faceplate of the digital line card (see [Figure 32](#)) is equipped with a red light emitting diode (LED) that lights when the card is disabled. When the card is installed, the LED remains lit for two to five seconds as a self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit until the card is configured and enabled in software, then the LED goes out. If the LED does not follow the pattern described or operates in any other manner (such as continually flashing or remaining weakly lit), the card should be replaced.

Figure 32
Digital line card—faceplate

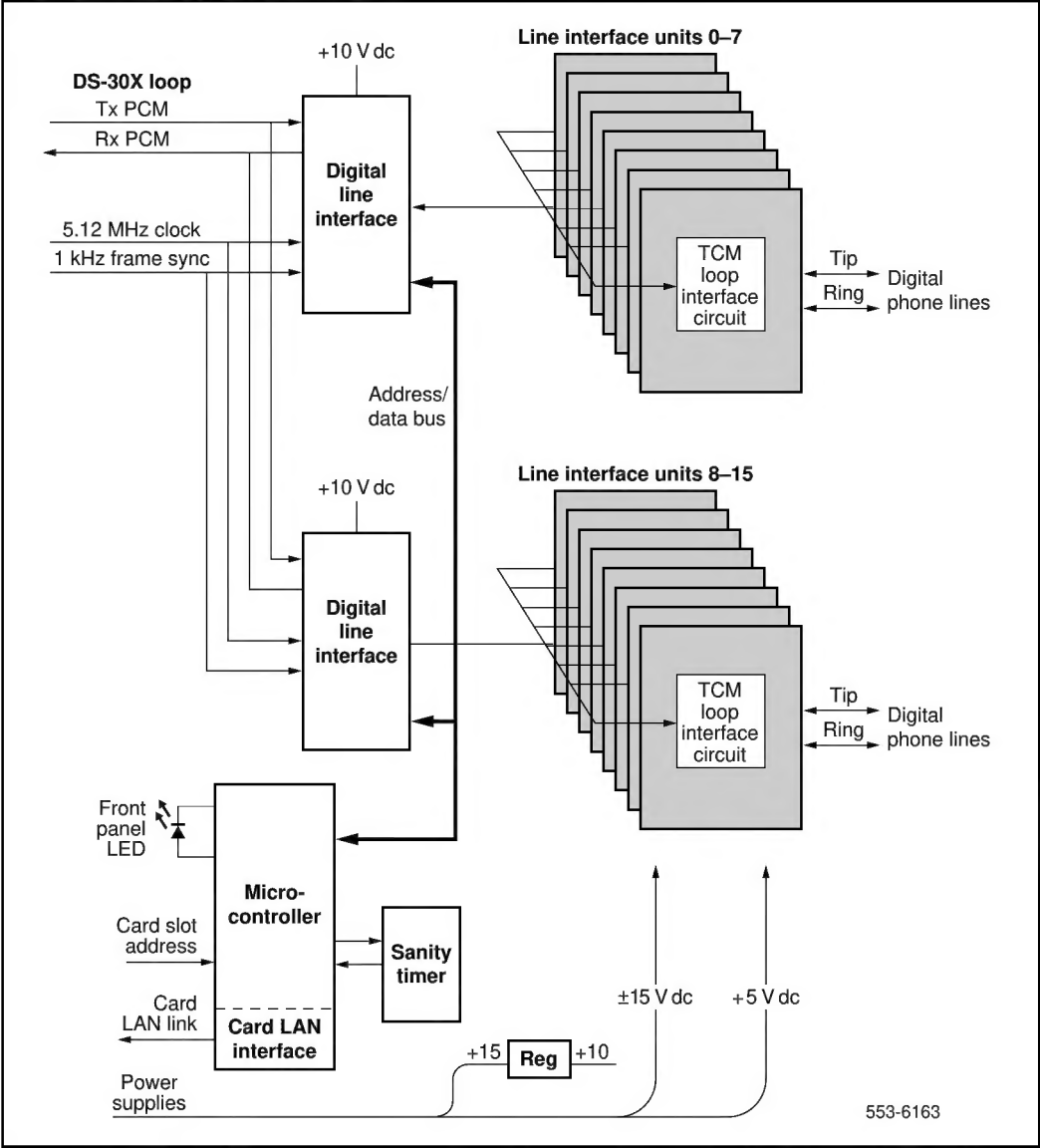


Functional description

The digital line card is equipped with 16 identical digital line interfaces. Each interface provides a multiplexed voice, data, and signaling path to and from a digital terminal (telephone) over a 2-wire full duplex 512 kHz time compression multiplexed (TCM) digital link. Each digital telephone and associated data terminal is assigned a separate terminal number (TN) in the system database, giving a total of 32 addressable units per card. The digital line card supports Northern Telecom's M2xxx, M3000, and Aries series digital telephone sets.

Figure 33 shows a block diagram of the major functions contained on the digital line card. Each of these functions are described on the following pages.

Figure 33
Digital line card—block diagram



Card interfaces

The digital line card passes voice, data, and signaling over DS-30X loops and maintenance data over the card LAN link. These interfaces are discussed in detail in the section “Intelligent peripheral equipment” on page 18.

Digital line interfaces

The digital line interface contains two digital line interface circuits (DLIC). Each digital line interface circuit provides eight identical and individually configurable voice and data interfaces to eight digital telephone lines. These lines carry multiplexed PCM voice, data, and signaling information as time compression multiplexed (TCM) loops. Each TCM loop can be connected to a Northern Telecom M2xxx, M3000, or Aries digital telephone set.

The purpose of each digital line interface circuit is to demultiplex data from the DS-30X Tx channel into eight integrated voice and data bitstreams and transmit those bitstreams as Bi-Polar Return to Zero, Alternate Mark Inversion (BPRZ-AMI) data to the eight TCM loops. They also do the opposite: receive eight BPRZ-AMI bitstreams from the TCM loops and multiplex them onto the DS-30X Rx channel. The two digital line interface circuits together perform the multiplexing and demultiplexing functions for the 16 digital telephone lines.

The digital line interface circuits also contain signaling and control circuits that establish, supervise, and take down call connections. These circuits work with the on-card microcontroller to operate the digital line interface circuits during calls. The circuits receive outgoing call signaling messages from the CPU and return incoming call status information to the CPU over the DS-30X network loop.

TCM loop interface circuit

Each digital phone line terminates on the digital line card at a TCM loop interface circuit. The circuit provides transformer coupling and foreign voltage protection between the TCM loop and the digital line interface circuit. It also provides battery voltage for the digital telephone set.

To prevent undesirable side effects from occurring when the TCM loop interface cannot provide the proper signals on the digital phone line, the card microcontroller can remove the ± 15 V dc power supply from the TCM loop interfaces. This happens when either the microcontroller gets a command from the NT8D01 controller card to shut down the channel or the digital line card detects a loss of the 1 KHz frame synchronization signal. The ± 15 V dc power supply signal is removed from all 16 TCM loop interface units at the same time.

Each TCM loop interface circuit can service loops up to 3500 ft. in length when using 24-gauge wire. They allow for a maximum AC signal loss of 15.5 dB at 256 KHz and a maximum DC loop resistance of 210 ohms.

Card control functions

Control functions are provided by a microcontroller and a Card LAN link on the digital line card. A sanity timer is provided to automatically reset the card if the microcontroller stops functioning for any reason.

Microcontroller

The digital line card contains a microcontroller that controls the internal operation of the card and the serial card LAN link to the controller card. The microcontroller controls the following:

- reporting to the CE CPU via the card LAN link:
 - card identification (card type, vintage, and serial number)
 - firmware version
 - self-test status
 - programmed configuration status
- receipt and implementation of card configuration:
 - programming of the digital line interfaces
 - enabling/disabling of individual units or entire card
 - programming of loop interface control circuits for administration of line interface unit operation
 - maintenance diagnostics

The microcontroller also controls the front panel LED when the card is enabled or disabled by instructions from the NT8D01 controller card.

Card LAN interface

Maintenance data is exchanged with the common equipment CPU over a dedicated asynchronous serial network called the Card LAN link. The Card LAN link is described in the section “Intelligent peripheral equipment” on page 18.

Sanity timer

The digital line card also contains a sanity timer that resets the microcontroller if program control is lost. The microcontroller must service the sanity timer every 1.2 seconds. If the timer is not properly serviced, it times out and causes the microcontroller to be hardware reset.

Circuit power

The +15 V dc input is regulated down to +10 V dc for use by the digital line interface circuits. The ± 15.0 V dc inputs to the card are used to power the loop interface circuits.

Electrical specifications

This section lists the electrical characteristic of the digital line card.

Digital line interface specifications

[Table 34](#) provides specifications for the 16 digital line interfaces, and [Table 35](#) lists the maximum power consumed by the card.

Table 34
Digital line card—line interface unit electrical characteristics

Characteristics	Description
Units per card	16 voice, 16 data
Line rate	512 kbps $\pm$ 100 ppm
Impedance	100 Ω
Loop limits	0 to 1067 m (3500 ft.) with 24 AWG PVC cable ($\pm$ 15 V dc at 80 mA)
Maximum AC Signal loss	15.5 dB at 256 KHz
Maximum DC Loop resistance	210 ohms
Transmitter output voltage:	
— successive “1” bits	$+1.5 \pm 0.15$ V and -1.5 ± 0.15 V
— “0” bits	0 ± 50 mV

Power requirements

The digital line card provides +15 V dc over each loop at a maximum current of 80 mA. It requires +15 V, -15 V, and +5 V from the backplane. One NT8D06 Peripheral Equipment Power Supply AC or NT6D40 Peripheral Equipment Power Supply DC can supply power to a maximum of 16 digital line cards.

Table 35
Digital line card—power required

Voltage	Current (max.)
±5.0 V dc	150 mA
+15.0 V dc	1.6 Amp
-15.0 V dc	1.3 Amp

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning is not provided on the digital line card. The digital line card does, however, have protection against accidental shorts to -52 V dc analog lines.

When the card is used to service off-premise telephones, primary and secondary main distribution frame (MDF) protection must be installed. Details on installing protection devices are given in “Off-premise line protection” on page 48. Off-premise telephones served by cable pairs routed through the central office, or crossing a public right-of-way, can be subject to a requirement for on-card protection, and MDF protectors may not be acceptable. Check local regulations before providing such service.

Environmental specifications

[Table 36](#) shows the environmental specifications of the card.

Table 36
Digital line card—environmental specifications

Parameter	Specifications
Operating temperature	0° to +60° C (+32 to +140° F), ambient
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	−40° to +70° C (−40° to +158° F)

Connector pin assignments

[Table 37](#) shows the I/O pin designations at the backplane connector, which is arranged as an 80-row by 2-column array of pins. Normally, these pin positions are cabled to 50-pin connectors at the I/O panel in the rear of each module for connection with 25-pair cables to the MDF.

The information in [Table 37](#) is provided as a reference and diagnostic aid at the backplane, since the cabling arrangement may vary at the I/O panel. See *Meridian 1 system installation procedures* (553-3001-210) for cable pinout information for the I/O panel.

Figure 34
Digital line card—typical cross connection example

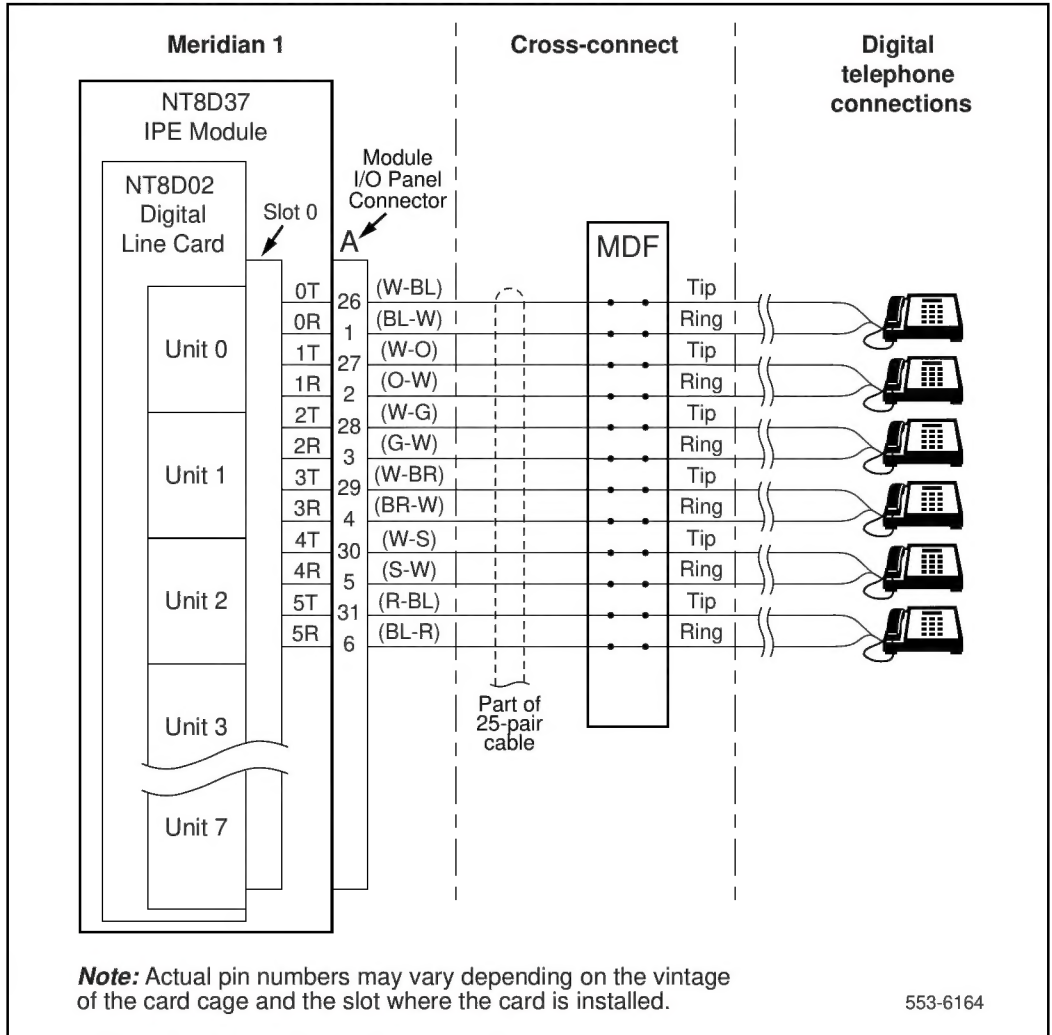


Table 37
Digital line card—backplane pinouts

Backplane Pinout*	Lead Designations	Backplane Pinout*	Lead Designations
12A	Line 0, Ring	12B	Line 0, Tip
13A	Line 1, Ring	13B	Line 1, Tip
14A	Line 2, Ring	14B	Line 2, Tip
15A	Line 3, Ring	15B	Line 3, Tip
16A	Line 4, Ring	16B	Line 4, Tip
17A	Line 5, Ring	17B	Line 5, Tip
18A	Line 6, Ring	18B	Line 6, Tip
19A	Line 7, Ring	19B	Line 7, Tip
62A	Line 8, Ring	62B	Line 8, Tip
63A	Line 9, Ring	63B	Line 9, Tip
64A	Line 10, Ring	64B	Line 10, Tip
65A	Line 11, Ring	65B	Line 11, Tip
66A	Line 12, Ring	66B	Line 12, Tip
67A	Line 13, Ring	67B	Line 13, Tip
68A	Line 14, Ring	68B	Line 14, Tip
69A	Line 15, Ring	69B	Line 15, Tip
* These pinouts apply to both the NT8D37 and NT8D11 backplanes			

Configuration

This section outlines the procedures for configuring the switches and jumpers on the NT8D02 Digital Line Card and configuring the system software to properly recognize the card. [Figure 35](#) shows where the switches and jumper blocks are located on this board.

Jumper and switch settings

The NT8D02 Digital Line Card has no user-configurable jumpers or switches. The card derives its address from its position in the backplane and reports that information back to the Meridian 1 CPU via the LAN Link interface.

Software service changes

Voice and data ports are configured using the Multi-line Telephone Administration program (LD 11). See the *X11 input/output guide* (553-3001-400) for LD 11 service change instructions.

Figure 35
Digital line card—jumper block and switch locations.

